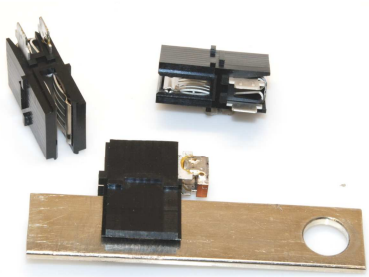
Job Number	Project Number:	Date of issue:
E08.11.14	E07.003	February 2009

Description:

Pluggable Busbar Connector with high current contacts, Crown Clip Junior

Part numbers:
1982530 rev. 2
2042305 rev. 3

Scope:
To determine the mechanical and electrical performance of the Crown Clip junior, when tested according to the Tyco Electronics Product specification 108-19360 rev. A.



Conclusions:

All test results meet the requirements according to the Tyco Electronics Product specification 108-19360 rev. A.

Test Specification:	Tyco Electronics Product specification 108-19360 rev. A	
Test Carried Out:	1 See page 2 and 4.	4
	2	5
	3	6
Distribution:	1 R. Lokker	
	2 Doc. Centre	
	3 File lab.	

Test Engineer:	J. Peetjens	**Requested by:** R. Lokker	
Laboratory Manager:	D. Jooren	**Classification:** Unrestricted	
Disposal of Samples:	Returned	**Report Number:** **501-19134**	Rev. O
Appendices:		**Page 1 of 9 Pages**	

SAMPLE DESCRIPTION

The test groups 1 to 5 consist of 6 connector systems, each system consisting of a Crown Clip Junior (P/N: 1982530 rev. 2) and a busbar (P/N: 2042305 rev. 3), see figure 1 below. The thickness of the used busbar conductor was 3.0±0.1mm and the busbar was post-plated with tin over nickel.

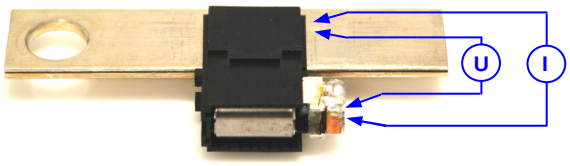


Figure 1

TEST PROCEDURES

IEC 60512-2-1:
Test 2a

Contact resistance:
The contact resistance was measured with an open circuit voltage of 20 mVolt and a maximum current of 100 mA DC.
For measuring points see figure 1.

IEC 60512-13-2:
Test 13b

Mating / unmating forces:
The test samples were mounted on a push-pull tester. During a mechanical operation, at a rate of 10 mm per minute, the mating and unmating forces were measured and the contact resistance was monitored. The measurement was executed with different pitches, for all pitch combinations see description and figure 2 below.

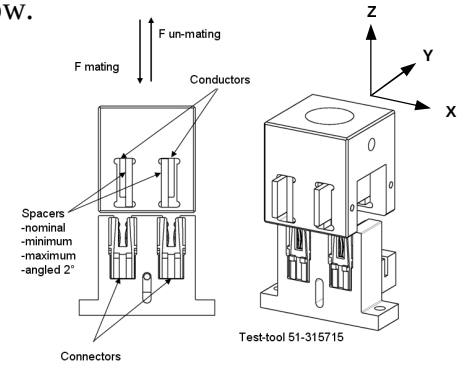


Figure 2

The pitch of the connectors in the test-tool was 25.0mm. The pitch of the conductors was adjusted by using spacers. The tested pitch combinations of the conductors were:

1. Pitch 25.0mm (nominal).
2. Pitch 24.0mm (minimal).
3. Pitch 26.0mm (maximal).
4. Pitch 24.0mm with conductors angled +2° & -2° in Y-direction.
5. Pitch 26.0mm with conductors angled +2° & -2° in Y-direction.
6. Pitch 25.0mm with conductors angled +2° & -2° in Z-direction.
7. Pitch 24.0mm with conductors angled +2° & -2° in Z-direction.
8. Pitch 26.0mm with conductors angled +2° & -2° in Z-direction.

IEC 60512-13-2:
Test 13b

PCB-insertion force:
The test samples were mounted on a push-pull tester.
During a press-in operation, at a rate of 10 mm per minute, the insertion force was measured, see figure 3.

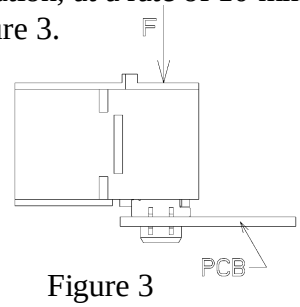


Figure 3

EC 60512-9-1:
Test 9a

Mechanical operation:
The samples were mated and unmated for 50 times at a rate of 600 cycles per hour. The pitch of the conductors and the connectors in the test-tool was 25.0mm.

Hot insertion/extraction force:
The samples were mated and unmated for 50 times at a rate of 600 cycles per hour with a current load of 150A.

IEC 60512-5-2:
Test 5b

Current-temperature derating curve:
The test samples were charged with a test current of successively 25, 50, 75, 100, 125, 150, 175 and 200A. The adjusted DC current was maintained for a stabilization period of 1 hour. After stabilisation at each current step, the temperature was measured.

IEC 60512-11-4:
Test 11e

Rapid change of temperature:
The samples were subjected to a rapid change of temperature test with the following parameters:
One cycle consists of:

Upper temperature	: 105°C for 30 minutes.
Lower temperature	: -55°C for 30 minutes.
Condition	: mated.
Number of cycles	: 25

IEC 60512-11-12:
Test 11m

Damp heat cyclic:
The samples were subjected to a cyclic damp heat test under the following conditions:

Upper temperature	: 55°C.
Lower temperature	: 25°C.
Relative humidity	: 95%.
Condition	: unmated.
Number of cycles	: 10.

IEC 60068-2-20,
Test Ta

Solderability:
The samples were plunged in a solder bath with a temperature of 260°C during 3 seconds.

IEC 60512-1-1:
Test 1a

Visual examination:
The test samples were visually inspected under a stereomicroscope, at a 10x magnification, with suitable illumination.

TEST SEQUENCE

Test group 1
-Visual examination
-Contact resistance
-Mating/Unmating force
-Mechanical operation
-Mating/Unmating force
-Contact resistance
-Visual examination

Test group 2
-Visual examination
-Current-temperature derating curve
-Visual examination

Test group 3
-Visual examination
-Contact resistance
-Rapid change of temperature
-Contact resistance
-Damp heat cyclic
-Contact resistance
-Visual examination

Test group 4
-Visual examination
-PCB insertion force
-Visual examination
-Solderability
-Visual examination

Test group 5
-Visual examination
-Contact resistance
-Hot insertion/extraction
-Contact resistance
-Visual examination

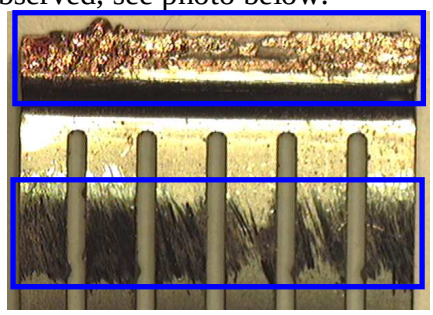
EQUIPMENT USED

Equipment	Producer	Type	Series Nb	Cal. Due
Tensile tester	MTS	400M	165811-20	09-10
Load cell	MTS	500N	2239	09-10
Current source	Delta	SM15-400	-1000034	
Micro-ohmmeter	Keithley	580	374687	01-10
Climatic chamber	CTS	TSS-70/130	98170	01-10
Climatic chamber	CTS	C-70/350	047018	01-10

SUMMARY OF TEST RESULTS:

MEASURED RESULTS		REQUIREMENTS	
Test group 1:(Mechanical Operation)			
●Contact resistance: (CR)			
Initial:	**max: 0.10mΩ.**	**Max: 0.2mΩ.**	**OK**
Mechanical Operation (final):	**max: 0.13mΩ.**	**Max: 0.2mΩ.**	**OK**
●Mating forces (Initial and final)			
-Pitch Combination 1	**max: 77N.**	**Max: 80N.**	**OK**
-Pitch Combination 2 to 8	**max: 95N.**	**Max: 100N.**	**OK**
●Unmating forces (Initial and final)			
-Pitch Combination 1	**52N-75N.**	**Between: 50±25N.**	**OK**
-Pitch Combination 2 to 8	**56N-95N.**	**Between: 75±25N.**	**OK**
● CR during mating/unmating operation:	**<0.20mΩ.**	**Max: 0.2mΩ.**	**OK**
●Visual examination			
No functional damage was observed.			
For all measuring results see on page 7 and 8.			
Test group 2: (Current & temp. derating curve)			
●Derating curve			
I = 0.8 x I supplied test current =>	**140A at ΔT=30°C.**	**At ambient temperature of 75°C a ΔTmax of 30°C.**	
●Temperature rise vs. current curve			
I = I supplied test current =>	**175A at ΔT=30°C.**		
For the derating curve and temperature rise vs. current curve, see page 8.			
Test group 3: (Climatic tests)			
●Contact resistance			
Initial:	**max: 0.10mΩ.**	**Max: 0.2mΩ.**	**OK**
Rapid change of temperature:	**max: 0.13mΩ.**	**Max: 0.2mΩ.**	**OK**
Damp heat cyclic (final):	**max: 0.11mΩ.**	**Max: 0.2mΩ.**	**OK**
●Visual examination			
No functional damage was observed.			
For all measuring results see on page 8.			
Test group 4:(PCB insertion force + solderability)			
●PCB insertion force:			
Initial:	**max: 726N.**	**Max: 800N.**	**OK**
●Solderability:		**No cracks, functional deformation or melting.**	**OK**
For all measuring results see on page 9.			

Test group 5:(Hot insertion/extraction)			
●**Contact resistance:** contact interface			
Initial:	**max: 0.10mΩ.**	**Max: 0.2mΩ.**	**OK**
Hot Insertion/Extraction (final):	**max: 0.11mΩ.**	**Max: 0.2mΩ.**	**OK**
●**Visual examination**			
At the contact interface no functional damage was observed, see photo below.		**No functional damage at the contact interface.**	**OK**



For all measuring results see on page 9.

TEST RESULTS

-Test group 1: Contact resistance

All values represented in milli-Ohms.						
Column.	**Group**	**Lot**	**Test**			
-1-:	1	1-6	Initial			
-2-:	1	1-6	After 50 mechanical operations, final			
Sample	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
1	0.09	0.12				
2	0.09	0.11				
3	0.08	0.10				
4	0.10	0.13				
5	0.08	0.12				
6	0.08	0.12				
Max.	**0.10**	**0.13**				
Min.	**0.08**	**0.10**				
Mean	**0.09**	**0.12**				

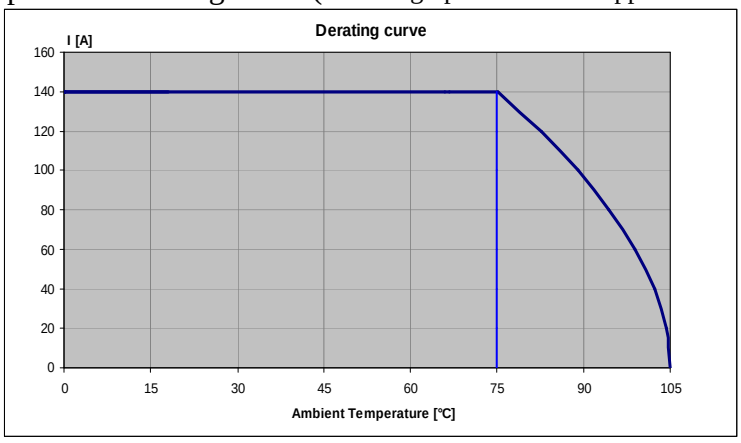
-Test group 1: Mating/Unmating force

All values represented in Newton.						
Column	**Group**	**Lot**	**Operation**	**Test**		
-1-:	1	1-2	Mating	Initial		
-2-:	1	1-2	Unmating	Initial		
-3-:	1	1-2	Mating	After 50 mechanicals operation cycles, final		
-4-:	1	1-2	Unmating	After 50 mechanicals operation cycles, final		
Lot / Pitch comb.	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
1-2 / 1	68.14	74.20	76.35	75.44		
1-2 / 2	71.26	64.93	80.21	78.44		
1-2 / 3	82.94	83.18	95.27	94.63		
1-2 / 4	65.22	65.20	71.81	69.71		
1-2 / 5	60.26	65.89	64.56	69.59		
1-2 / 6	76.93	74.23	88.11	81.22		
1-2 / 7	80.70	83.69	82.19	83.46		
1-2 / 8	94.31	88.21	97.55	87.80		
Max.	**94.31**	**88.21**	**97.55**	**94.63**		
Min.	**60.26**	**64.93**	**64.56**	**69.59**		
Mean.	**74.97**	**74.94**	**82.01**	**80.04**		

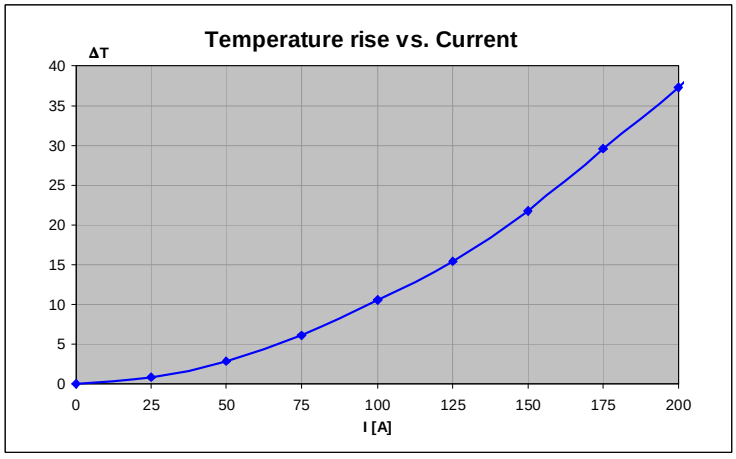
All values represented in Newton.						
Column	**Group**	**Lot**	**Operation**	**Test**		
-1-:	1	3-4	Mating	Initial		
-2-:	1	3-4	Unmating	Initial		
-3-:	1	3-4	Mating	After 50 mechanicals operation cycles, final		
-4-:	1	3-4	Unmating	After 50 mechanicals operation cycles, final		
Lot / Pitch comb.	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
3-4 / 1	43.81	51.74	76.98	72.89		
3-4 / 2	57.02	55.56	66.50	65.79		
3-4 / 3	62.67	65.63	74.36	77.77		
3-4 / 4	55.46	56.51	65.75	69.39		
3-4 / 5	56.82	58.06	63.86	62.99		
3-4 / 6	70.19	78.57	85.58	78.69		
3-4 / 7	81.29	84.63	84.95	81.21		
3-4 / 8	91.11	86.09	84.95	81.21		
Max.	**91.11**	**86.09**	**85.58**	**81.21**		
Min.	**43.81**	**51.74**	**63.86**	**62.99**		
Mean.	**64.80**	**67.10**	**75.37**	**73.74**		

All values represented in Newton.						
Column	**Group**	**Lot**	**Operation**	**Test**		
-1-:	1	5-6	Mating	Initial		
-2-:	1	5-6	Unmating	Initial		
-3-:	1	5-6	Mating	After 50 mechanical operation cycles, final		
-4-:	1	5-6	Unmating	After 50 mechanical operation cycles, final		
Lot / Pitch comb.	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
5-6 / 1	54.25	69.67	74.33	74.53		
5-6 / 2	74.13	79.78	77.52	74.72		
5-6 / 3	78.31	83.40	84.41	85.80		
5-6 / 4	62.84	68.32	60.81	66.85		
5-6 / 5	58.29	61.68	68.04	67.24		
5-6 / 6	72.88	72.52	85.98	77.18		
5-6 / 7	77.32	72.72	83.45	77.23		
5-6 / 8	82.84	76.65	79.86	68.87		
Max.	**82.84**	**83.40**	**85.98**	**85.80**		
Min.	**54.25**	**61.68**	**60.81**	**66.85**		
Mean.	**70.11**	**73.09**	**76.80**	**74.05**		

-Test group 2:
Current and temperature derating curve (**I** in the graph= **0.8** x **I** supplied test current)



Temperature rise vs. current curve (**I** in the graph = **I** supplied test current)



-Test group 3: Contact resistance

All values represented in milli-Ohms.						
Column.	**Group**	**Lot**	**Test**			
-1-:	3	1-6	Initial			
-2-:	3	1-6	After rapid change of temperature			
-3-:	3	1-6	After damp heat cyclic, final			
Sample	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
1	0.09	0.10	0.09			
2	0.10	0.12	0.11			
3	0.09	0.12	0.09			
4	0.10	0.13	0.11			
5	0.10	0.13	0.09			
6	0.10	0.11	0.09			
Max.	**0.10**	**0.13**	**0.11**			
Min.	**0.09**	**0.10**	**0.09**			
Mean	**0.10**	**0.12**	**0.10**			

-Test group 4: PCB insertion force

All values represented in Newton.						
Column	**Group**	**Lot**	**Compress**	**Test**		
-1-:	4	1-10	Peak Load	PCB insertion force		
Sample	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
1	592					
2	625					
3	702					
4	668					
5	695					
6	726					
Max.	**726**					
Min.	**592**					
Mean.	**672.4**					

-Test group 5: Contact resistance

All values represented in milli-Ohms.						
Column.	**Group**	**Lot**	**Test**			
-1-:	5	1-6	Initial			
-2-:	5	1-6	After Hot insertion / extraction, final			
Sample	***-1-***	***-2-***	***-3-***	***-4-***	***-5-***	***-6-***
1	0.08	0.08				
2	0.08	0.09				
3	0.09	0.11				
4	0.08	0.10				
5	0.10	0.10				
6	0.08	0.10				
Max.	**0.10**	**0.11**				
Min.	**0.08**	**0.08**				
Mean	**0.08**	**0.10**				